

## NESTLING FOODS AND FORAGING PATTERNS IN THE CLAY-COLORED SPARROW

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The Clay-colored Sparrow (*Spizella pallida*) is a common breeding bird of central North America (Bent 1968, Erskine 1977), but little is known of its feeding ecology. In this paper, I report on nestling foods, on foraging behavior and on locations where prey was gathered, and I compare prey items brought to young among different pairs and between males and females within each pair. The Clay-colored Sparrow is an appropriate study animal as it is relatively easy to catch, its nests are not difficult to find, it readily accepts blinds close to the nest and it is easy to observe in the low shrub communities and surrounding meadows, marshes and pastures which it inhabits.

### METHODS

The study was carried out in extreme southwestern Manitoba near the town of Lyleton. Two study areas were chosen, each incorporating extensive stands of low shrubs, primarily snowberry (*Symphoricarpos occidentalis*) and silverberry (*Elaeagnus commutata*), with small areas of grass and of trembling aspen (*Populus tremuloides*). Study area 1 was a 5.86-ha plot about 2 km west of Lyleton, and study area 2 comprised 5.67 ha 14 km northwest of Lyleton (for further details see Knapton 1979). Daily observations were made during the breeding seasons of 1974-1976.

Adult and immature Clay-colored Sparrows were captured in mist nets and nestlings were banded at about 5 days of age. Each bird received an aluminum band plus 2 colored plastic bands in different combinations for individual recognition.

I observed individual sparrows in areas around the nesting habitat (the low shrub communities) during May and early June. I noted the identity of each bird, where it was foraging, and whether it was foraging alone or close (within 5 m) to another bird. From 15 June to 17 July 1976, I spent 65 h observing 7 pairs of Clay-colored Sparrows that were feeding nestlings. Observation periods were usually about 2-h long, and were carried out between 06:00 and 12:00 from blinds located 5-10 m from the nest. Pairs appeared to accept the presence of blinds, and no nest under observation was deserted or lost to predators. Information was recorded on portable tape recorders and later transcribed.

The parent's line of flight on leaving the nest was recorded as 1 of 8 possible compass directions. Locations to which the parent birds flew to forage were recorded, and the distances determined by plotting the foraging locations on aerial photographs and measuring the distance to the nest. It was relatively easy to observe how far individuals flew before alighting, as the low height of the vegetation permitted an extensive panoramic view of surrounding areas.

I obtained information on prey items brought to the young by 2 methods. I used a portable Sony Videocorder equipped with a 230 mm lens, and filmed parent birds carrying food items in their beaks. Characteristically, each parent bird returning with prey perched conspicuously for several seconds before dropping down into the shrubbery to the nest; this allowed

several seconds of film footage to be taken per prey item. The video tapes were later analyzed on closed-circuit television, a still switch on the videocorder allowing close analysis of individual frames. It was possible to identify most prey items at least to order.

I also obtained actual samples of food delivered to nestlings in 4 other nests using the neck-band method. I attached ligatures around the necks of young Brown-headed Cowbirds (*Molothrus ater*), 1 cowbird in each nest, each cowbird from 5–7 days old. Each young cowbird was in a Clay-colored Sparrow nest in which the sparrow's own young were no longer present. The ligatures were left on the young cowbirds for about 1 h at a time. Ligatures were not placed on young Clay-colored Sparrows because concurrent information was being collected on survival rates of the young sparrows, and repeated visits to their nests within 1 day might have influenced predation rates. Also, nestling Clay-colored Sparrows 6 days or older cannot be easily returned to the nest-bowl, and handling often causes nest departure prematurely.

The ligature method is not without potential error, as small prey items can slip through the ligature or else food can be coughed up and eaten by the parents (Orians 1966). The similarity in results (see below) between the videocorder and the ligature methods suggest that errors were not large.

## RESULTS

*Foods presented to nestlings.*—Adult Clay-colored Sparrows fed their young a wide variety of invertebrates (Table 1). Predominant foods were lepidopteran larvae, orthopteran nymphs and various types of Odonata. These 3 groups comprised 76% of the total number of prey items recorded. A similar breadth of diet is evident in the sample of prey items collected from the nestling cowbirds (Table 1), mainly lepidopteran larvae and orthopteran nymphs, indicating that adult sparrows brought the same sorts of food to young cowbirds as they did to their own young.

There were large differences between pairs in foods presented to nestlings (Table 2). Pair 5, whose territory was close to a pond overgrown with smartweed (*Polygonum* spp.), fed their young almost exclusively on narrow-winged damselflies (Coenagrionidae), apparently taking advantage of a readily available and abundant food source localized around the pond. Pair 6 fed their young mostly short-horned grasshoppers (Acrididae), whereas lepidopteran larvae predominated in the food of the remaining 5 pairs.

Males and females brought the same type of prey items to their young in roughly the same proportions (Table 2). Horn's (1966) measure of overlap,  $C$ , is given by

$$C = \frac{2 \sum_{i=1}^s X_i Y_i}{\sum_{i=1}^s X_i^2 + \sum_{i=1}^s Y_i^2}$$

where  $X_i$  and  $Y_i$  are the proportions of prey species  $i$  for males and fe-

TABLE 1  
FOOD ITEMS BROUGHT TO 11 CLAY-COLORED SPARROWS' NESTS<sup>1</sup>

Prey group	Videocorder information		Ligature information	
	Number	Percent	Number	Percent
Orthoptera	108	18.1	11	29.7
Neuroptera	11	1.8		
Lepidoptera (adult)	23	3.8		
(larvae)	256	42.8	15	40.5
Odonata	93	15.6	3	8.1
Coleoptera	12	2.0	4	10.8
Hemiptera	1	0.1		
Diptera	58	9.7	4	10.8
Araneida	4	0.7		
Unidentified	32	5.4		
Total	598	100	37	100

<sup>1</sup> Food was recorded at 7 nests by videocorder and at 4 nests by ligatures on young cowbirds (28 samples).

males, respectively. A value of 0% means no overlap, a value of 100% means total overlap. For Clay-colored Sparrows, C is 96%, indicating there is no difference between males and females within each pair in prey items presented to nestlings.

There was a noticeable change in the relative importance of major food items during the breeding season. Proportionately more lepidopteran larvae were taken in June, Odonata increased in July, and there tended to be a general increase in the relative numbers of orthopteran nymphs over the breeding season. These trends are similar between males and females (Knapton 1978a).

*Foraging behavior.*—Observations throughout the breeding season on several pairs of banded Clay-colored Sparrows indicated that the birds did not obtain food for themselves or for their young in their territories. Up to mid-May, male Clay-colored Sparrows sometimes fed in grassy areas adjacent to their territories, possibly because they were reluctant to fly far from their territories before territorial boundaries were firmly established. After mid-May, foraging and food-gathering for the young occurred away from the breeding areas, in arable and pasture land, weedy fields and around the edges of sloughs and marshes.

Between territory establishment and the nestling stage of the reproductive cycle, males of adjacent territories foraged at about the same time of day (late morning and late afternoon) off the breeding areas. No overt aggressive interactions were observed between males foraging off territory during 15 h of observation from 6 May to 2 June 1976, although on 9

TABLE 2

FOODS PRESENTED TO NESTLINGS BY EACH OF 7 PAIRS OF CLAY-COLORED SPARROWS

Prey group	Pair 1		Pair 2		Pair 3		Pair 4		Pair 5		Pair 6		Pair 7		Total	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Orthoptera	9	6	5	2	13	10	10	8	1	0	27	17	0	0	65	43
Neuroptera	3	0	0	1	0	1	0	4	0	1	0	1	0	0	3	8
Lepidoptera																
(adult)	0	0	4	0	4	3	6	2	0	0	1	3	0	0	15	8
(larvae)	21	24	26	18	38	30	23	26	0	1	2	6	23	18	133	123
Odonata	4	8	5	2	0	1	0	2	30	36	1	2	2	0	42	51
Coleoptera	1	4	0	0	0	0	3	3	0	0	1	0	0	0	5	7
Hemiptera	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
Diptera	16	6	5	7	0	5	2	7	0	0	1	0	4	3	30	28
Araneida	0	0	0	0	1	3	0	0	0	0	0	0	0	0	1	3
Unidentified	4	2	6	4	2	1	1	1	1	1	3	2	2	1	19	13

occasions males from adjacent territories were observed within 5 m of each other in the foraging areas. Furthermore, although individual males seemed to forage in specific locations, there was no indication that males defended feeding territories.

*Flight lines.*—Parents were not observed to gather food for their young within the confines of the territory nor over the breeding habitat as a whole. I therefore recorded the lines of flight which the birds followed between the nest and the foraging locations.

There were no major differences between members of a pair in the direction flown from a nest towards the foraging locations (Knapton 1978a). In general, a male and a female of a pair, whether leaving the nest singly or together, flew predominantly in one and the same direction towards the foraging locations.

Pairs 1 and 5 held peripheral territories, and they used feeding areas adjacent to their territories. Pairs holding central territories flew to probably the closest available foraging locations. Pairs 3 and 4, which held adjacent territories and were feeding nestlings at the same time, consistently flew to the southwest on leaving their nests, and both pairs foraged in and around a large pond overgrown with vegetation. This suggests that neighboring birds might be following each other to preferred feeding locations. However, the pond was probably the closest foraging location to both nests, and hence evidence for following remains inconclusive.

*Distances foraged from the nest.*—Pair 7 is omitted from this analysis as these birds frequently flew around an intervening clump of trees on leaving the nest, and hence went out of sight. Foraging distances (Table 3) varied

TABLE 3  
DISTANCES (M) FROM THE NEST THAT MALE AND FEMALE CLAY-COLORED SPARROWS  
FLEW TO FORAGE

Pair no.	Male		Female	
	No. foraging trips	$\bar{x} \pm SD$	No. foraging trips	$\bar{x} \pm SD$
1	26	46.2 $\pm$ 18.6	21	29.9 $\pm$ 20.1
2	41	89.9 $\pm$ 15.6	32	78.9 $\pm$ 13.6
3	38	56.2 $\pm$ 6.8	34	51.6 $\pm$ 5.8
4	29	75.3 $\pm$ 12.4	32	67.5 $\pm$ 8.8
5	30	32.5 $\pm$ 6.0	31	31.1 $\pm$ 5.4
6	18	94.7 $\pm$ 8.1	22	77.3 $\pm$ 20.2

between pairs, and this was partially due to the location of the territory. Pairs 1 and 5, holding territories on the periphery of the nesting habitat, flew shorter distances, presumably because foraging locations were closer than the other 4 pairs, which held territories in the middle of the nesting habitat.

The mean distances from the nest to the foraging areas were compared between mates for each direction flown (Fig. 1), and were found to be significantly different for all pairs combined ( $G = 13.28$ ,  $P < 0.005$  [goodness-of-fit test, Sokal and Rohlf 1969]). Within most pairs, the male flew farther, on average, from the nest to the foraging locations than the female. This was particularly evident when the pair left the nest together; the female alighted first and closer to the nesting area than the male, who flew farther on and alighted. This suggests that there is spatial partitioning of the foraging areas between members of a pair.

#### DISCUSSION

Clay-colored Sparrows presented a wide variety of prey items to their young, and they collected the prey in a variety of foraging locations off territory. Different pairs brought different prey items in different proportions to their young.

A change in proportion of prey items in the nestling diet as the young grow older has been indicated in some passerines (Betts 1955, Royama 1970, Robins 1971, Best 1977). In the Clay-colored Sparrow, similar-aged nestlings did not receive the same foods. For example, the oldest nestlings in nests 1, 4 and 6 were about the same age (6 days old), yet orthopteran nymphs were more prominent in pair 6's prey items, whereas lepidopteran larvae predominated in the other two. Moreover, the oldest nestlings in nests 2, 5 and 7 were about 5 days old; Odonata were the chief food at

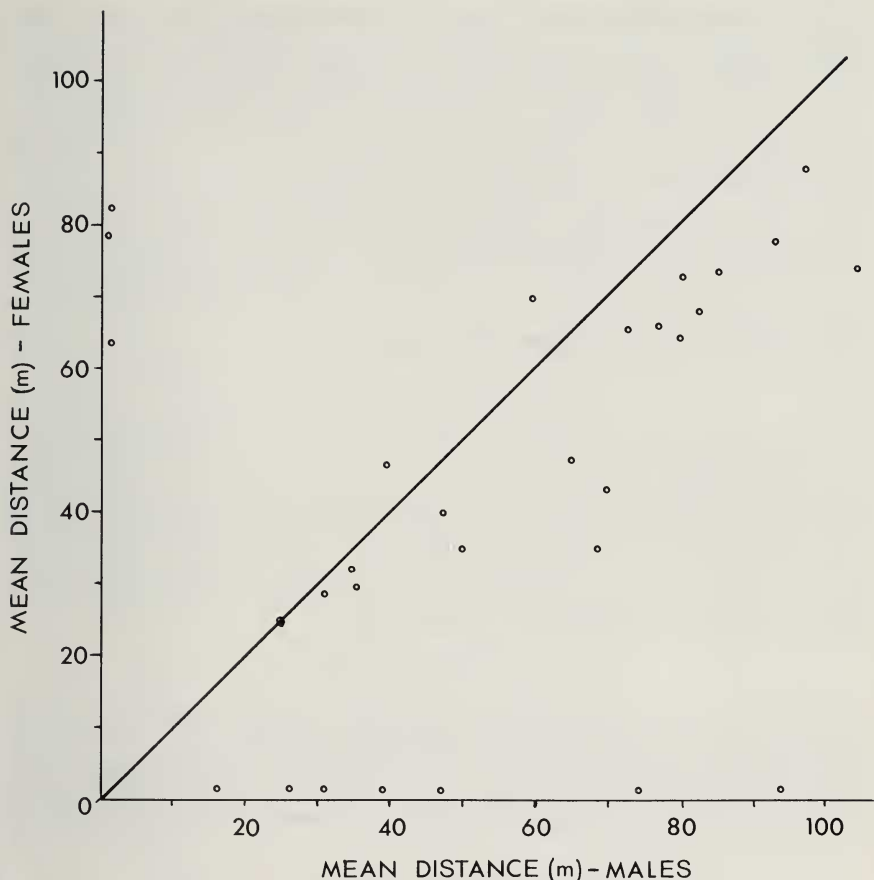


FIG. 1. Comparison of foraging distances between males and females in 6 pairs of Clay-colored Sparrows in 1976. Each point plots the mean distance flown in 1 direction by a male against that flown by his mate. Number of directions flown by each pair ranged from 2-6. Points lying below the line (slope of 1) indicate that males flew farther; points above the line that females flew farther.

nest 5 and lepidopteran larvae at the other two. This suggests that the birds were not selectively choosing prey according to age of the nestlings. However, nestlings of pair 3, the youngest nestlings under observation at about 3 days old, were the only ones to receive spiders, which is consistent with Royama's (1970) suggestion that spiders have special nutritional value important for nestling growth at an early age.

Males and females within a pair did not differ either in type or proportion of prey items presented to their young (Table 2). Hence, the sexes did not



appear to select different food items in order to reduce intersexual competition. This is perhaps not surprising as the sparrows are essentially monomorphic in culmen depth and length, and in length of tarsometatarsus (Knapton 1978b). Although males and females used essentially the same types of food, they appeared to spatially partition the food gathering areas. Within a pair, the male, on average, foraged at a slightly greater distance from the nest than the female, a tendency reported in other passerines (Morse 1968, Wiens 1969, Robins 1971, Busby 1978). In the Clay-colored Sparrow, it is not known if this is a mechanism to reduce intersexual competition for food, or is a result of a greater tendency in females to be more nest oriented than males.

#### SUMMARY

Feeding ecology of the Clay-colored Sparrow was studied in 2 banded populations in southwestern Manitoba. Adults brought to their young a wide variety of prey items which they collected off territory and away from the breeding habitat. There were large differences between pairs in proportions of prey items collected, and each pair was probably exploiting whatever suitable foods were seasonally available. There were no major differences between members of a pair in food items brought to the young, or in the direction of foraging flights. However, within each pair, the male foraged at greater distances from the nest than the female, suggesting spatial partitioning of foraging areas.

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## WOS ANNUAL MEETING

The annual meeting of The Wilson Ornithological Society will be held in Sackville, New Brunswick, from 4 to 7 June 1981.

### NOTICE OF A VOTE TO CHANGE THE BYLAWS

The membership is herewith notified of proposed changes in the Bylaws which will be voted on at the annual business meeting as follow: Article 2, Section 2, second sentence "Nominations and applications for membership shall be made through the Secretary" and last sentence "Nominations presented in the interim between the annual meetings shall be received and confirmed by the Secretary, . . ." the word "Secretary" to be changed to "Treasurer." These changes will bring our Bylaws into conformance with practices and procedural necessity.